A Description of the New Mechanical Power, or, Steelyard Purchase.

Smeeton, Printer, St. Martin's Lane.

1800.

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TO
The Hon. the Lords Commiſſioners of the Admiralty;
THE HON. THE PRINCIPAL OFFICERS, AND
COMMISSIONERS OF HIS MAJESTY'S NAVY;
THE
ADMIRALS, CAPTAINS, AND COMMANDERS
OF HIS MAJESTY'S FLEET;
The Hon. the Directors of the Eaſt India Company,
AND TO THE CAPTAINS AND COMMANDERS OF THE HON.
EAST INDIA COMPANY'S SHIPS;
To all Merchants and Sea-faring Men in particular;
AND
TO THE PUBLIC IN GENERAL;
The NEW MECHANICAL POWER,
DENOMINATED
The Steelyard Purchase,
By His MAJESTY'S ROYAL LETTERS PATENT,
GRANTED UNTO
John Hotchkis, Lieut. of the Royal Navy,
THE INVENTOR;
For WEIGHING ANCHORS, MOVING SHIPS, &c.
Is here humbly ſubmitted to
THEIR INSPECTION AND PATRONAGE.

Preface.

THE deſign at firſt, of making this mechanical power known to the public, originated from the author's being preſent, and at that time ſerving on board of one of his Majeſty's ſhips of 80 guns, with her full complement of men, when it was with the utmoſt difficulty that her anchor could be weighed by the mechanical powers which ſhe had on board, and which are at this time the mechanical powers uſed on board his Majeſty's ſhips upon the like occaſion.

It appeared to the author that a mechanical power was wanted, which would not loſe its power when a great ſtrain was brought upon it, which is the caſe with tackles, the machines which are uſed at preſent when anchors will not ſtart by the common method employed in weighing them. At the time alluded to above, where the anchor was weighed with ſo much difficulty, a number of different falls were rove in the blocks which were applied to the cable, and broke one after the other, and laſt of all the blocks themſelves

were

were rendered unſerviceable, before the purpoſe for which they had been put on board was accompliſhed; and which was finally accompliſhed by means of a whip purchaſe, made with the viol block and meſſenger.

The author flatters himſelf that the evils ariſing by uſing thoſe kind of machines (tackles) in this kind of ſervice, would be much remedied by uſing this ſimple, though powerful purchaſe, which he now ſubmits to the public notice.

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DESCRIPTION

OF THE

NEW MECHANICAL POWER,

OR,

Steelyard Purchaſe.

CHAP I.

A Deſcription of the Principle upon which the Steelyard Purchaſe acts; and of the Table at the End of the Pamphlet with Examples to ſhew how it is uſed.

THE mechanical power, or purchaſe, here ſubmitted to the inveſtigation, and if it anſwers the deſcription, to the patronage of the public, acts upon the principle of a perpetual ſteelyard, conſequently one arm longer than the other; and as the weight to be lifted is ſuſpended at the ſame time to both arms, by means of a block, that weight (the weight to be lifted) is made to aſſiſt in lifting itſelf in the proportion which the ſhort arm bears to the long one. A view of this purchaſe, applied to a cable on board of a man of war, is given in the frontiſpiece.

The table inſerted at the end of the pamphlet, ſhews the proportion of large, and ſmall barrels of capſtans for this purchaſe, from large barrels of 24 inches in diameter, up to 72 inches in diameter. The firſt column ſhews the dimenſions of the large barrels, the ſecond column the dimenſions of the ſmall barrels, the third column the number of times power is encreaſed, and the laſt column the length gained upon whatever the block is made faſt to, in one turn round of the capſtan. I ſhall here give ſome examples to ſhow the uſe of the table

Example firſt. A ſhip has on board a capſtan whoſe large barrel is 48 inches in diameter; it is required, the diameter of the ſmall barrel for that capſtan to make the ſteelyard purchaſe 8 times the power of the large barrel when it is uſed by itſelf. Turn to the table, and look in the firſt column for 48 inches, which is the diameter of the large barrel, then in the third column, under power encreaſed, look within the circumflex againſt 48. for 8, then look in the ſecond column oppoſite to 8. and the figures oppoſite

poſite to it will be the diameter required for the ſmall barrel, viz. 42 inches.

Example ſecond. A ſhip has on board a capſtan whoſe large barrel is 39 inches in diameter; it is required the diameter of the ſmall barrel for that capſtan to make the ſteelyard purchaſe 6 times the power of the large barrel when it is uſed by itſelf. Turn to the table as before, and look in the firſt column for 39 inches, or the neareſt number to that which is 36, or 42. (I ſhall ſtate it here 36) then look in the column, power encreaſed, within the circumflex againſt 36, for 6, and in the column on the left hand ſide oppoſite to 6, you will find 30 inches in diameter, which is the dimenſions for a capſtan of 36 inches; then ſtate the queſtion, if 36 give 30, what will 39 give?

```
          ×39.
           30.
        ------
÷36.)1170.(32.5 inches
      108
      ----
        90
        72
      ----
       180
       180
      ----
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The anſwer comes to 32. ½ inches, which is the dimenſion required.

Example third. A ſhip has on board a capſtan whoſe large barrel is 56 inches in diameter; it is required the diameter for the ſmall barrel to make the ſteelyard purchaſe 3 times the power of the large barrel when uſed by itſelf. Turn to the table as before, and look in the firſt column for 56 or the neareſt number to it, which is 54, then look in the column, power encreaſed, within the circumflex againſt 54 for 3, and in the left hand column, oppoſite to 3, you will find 36, which is the dimenſions for a capſtan of 54 inches; then ſtate the queſtion, if 54 require 36, what will 56 require?

$$\begin{array}{r}
\times 36. \\
56. \\
\hline
216 \\
180 \\
\hline
\end{array}$$

$\div 54.)2016.(37.33$ inches

The anſwer comes to 37.33 inches, which is the dimenſions required.

CHAP.

CHAP. II.

Deſcription of the Manner of clapping on, and applying the Steelyard Purchaſe on board of Ships; Caſes in which it would be found uſeful; Remarks upon Tackles; and upon Purchaſes uſed in Italy in lifting heavy blocks of Marble.

THE ſmall barrel of the capſtan altered on board of any ſhip according to the table, a block on board which will reeve the meſſenger, and a thumb-cleat, which will take the meſſenger, brought on upon the ſhip's ſide, ſo as the meſſenger when put over the thumb will be a little higher than the upper turn on the ſmall barrel of the capſtan; the ſhip is hove ſhort, and the anchor will not ſtart by the common method; the cable is firſt to be ſtoppered, and the purchaſe block laſhed on about the manger board: during the time this laſhing is clapping on, the eyes of the meſſenger are to be unlaſhed, and three turns to be taken on the ſmall barrel of the capſtan the contrary way to what the turns are taken upon the large barrel, and this part of the meſſenger to be paſſed between the pumps, and the main maſt on the ſame ſide of the maſt with the

the heaving part of the meſſenger, one end of the meſſenger to be now rove through the block ſo as the two parts will lead fair from their reſpective barrels to the block; the eyes of the meſſenger to be now laſhed as before, the turns laid fair on the barrels, and the giving-in part of the meſſenger, which goes to the ſmall barrel, ſnatched in the thumb-cleat at the ſhip's ſide; then hold on, heave round upon the large barrel; as ſoon as both parts of the meſſenger are taught, unſtopper the cable, and be careful of not ſurging the part of the meſſenger which is round the ſmall barrel. The anchor is a weigh, clap on nippers upon the part of the meſſenger which goes from the block to the large barrel of the capſtan; nippers on; cut the laſhing of the block, and make the block faſt to a bolt or ſtancheon amidſhips, ſo as the block will be a guide to the meſſenger for coming fair to the cable for clapping on the nippers; heave round again, and get the anchor up to the bows. The part of the meſſenger which is round the ſmall barrel will be no interruption, as it is hove off that barrel, as the other part is hove on the large barrel.

Among the many caſes where this purchaſe would be found uſeful to the public, the following

lowing caſes appear to me very conſpicuous. Firſt on board of all ſhips, where it is found difficult to ſtart an anchor by the common method: where the capſtan or winlaſs employed is placed ſufficiently aft to allow this purchaſe to be uſed, it particularly here has greatly the advantage of tackles which are the machines uſed at preſent on board of ſhips, when their anchors cannot be weighed by the common method; the friction on the ſteelyard purchaſe being much leſs, the time taken to clap it on much ſhorter, conſequently the getting to work with it much quicker, and the ſtrength of the materials employed much greater than in tackles, and when the anchor is hove out of the ground from the eaſe, the meſſenger is again applied to heave the anchor up to the bows of the ſhip in the ſame manner, as was done before this purchaſe was clapped on.

The ſecond caſe where it appears to me this purchaſe might be very uſefully employed, would be in heaving ſhips down.

The next caſe in heaving ſhips into, or out of dock, where the water is ſcant, in this inſtance I think, ſhips would be often got both into, or out of dock, when either the one, or the other could

could not be done by the purchaſes uſed in the preſent practice.

The next caſe in which it ſtrikes me this purchaſe would be uſefully employed, is, in maſting of ſhips, which in the preſent practice is done by tackles.

The laſt caſe I ſhall mention here in which this purchaſe would be found uſeful, is on board of anchor lighters, in weighing anchors, which have lain long in the ground.

In treating of this purchaſe, and comparing it with tackles, I have always given my diſapprobation to uſing of theſe machines, when a great ſtrain is brought upon them; my reaſon for doing ſo is, that I never ſaw a tackle-fall brought to a capſtan, and any thing like a ſtrain hove upon it, that it did not break at the heaving part, or the next part of the fall to that, at the ſame time when the fall did break, the ſtanding part had upon it very little of the ſtrain, when the purchaſe conſiſted of 5, or 6 ſheaves; the reaſon of this appears to me to be, that the eyes of the ſtraps of the blocks, one of which is made faſt to a fixture, and the other to whatever is to be lifted, are the centres of this machine, the working part of the fall does not work in a line with theſe centres, when the number of ſheaves exceeds two, that is to ſay, two ſingle-ſheaved blocks, or what is termed a gun-tackle purchaſe; and when the ſtrain comes to be very great, and the thing to be lifted will not move, the blocks are hove more and more off their centres, the communication between the different parts of the fall is greatly interrupted by the fall and ſheaves reſting on the ſides of the blocks, and conſequently the fall breaks where moſt ſtrained. I think I may venture an aſſertion with regard to tackles, when the fall breaks from a ſtrain being hove upon them (ſuppoſing the tackle to conſiſt of two four-fold blocks) that there is at that time only a power acting by means of the tackle equal to two ſingle-ſheaved blocks; to confirm this farther, when tackles are uſed by hand, and only a weight of 3 or 4 tons to be lifted by them, their loſs of power is very great, and one inſtance will be ſufficient to ſhew it. The cat-purchaſe conſiſts of two three-fold blocks, and when the anchor is to be liſted up to the cat-head, almoſt the whole of the crew of a man of war is clapped on to the fall to get this anchor up. I never ſaw that trifling weight, when compared to the number of men employed upon it, run up to the cat-head, tho' the men were in ever ſuch good humour, but indeed when they

they made a walk with it, and did not ſtop till the anchor was up, the thing was in general thought to be very well done in all the men of war I have ever belonged to. But to inveſtigate this farther; on board of the Gibraltar of 80 guns (the ſhip which I allude to in the preface) whoſe bower anchors were about 4 tons or 8960 libs, and whoſe cat-purchaſe was two threefold-blocks, which in the manner they are placed makes their power encreaſe 5 times, which reduces the weight of the anchor to 1990 libs. now I ſhall ſuppoſe 300 men were pulling at this fall, the exertion each man would have to make by calculation comes only to 6 libs. and ¾; I am ſure, take the average of the actual exertion which I have ſeen as great a number of men make upon this fall, with that weight attached to it at 20 libs. per man, I do not think I ſtate it at too much; ſo that three parts out of four of the exertion made is loſt upon this kind of machine where one of the blocks is a fixture, and conſequently leſs liable to be moved off its centre than if it hung from a point, which is the caſe with the tackle made uſe of to weigh anchors.

In Italy, in moving heavy blocks of marble, windlaſſes, or capſtans of a ſmall diameter are uſed,

uſed, in preference to encreaſing power by tackles farther than by a ſingle-ſheaved block; and the diameter of the windlaſs, or capſtan, is made as ſmall as the ſtrength of the materials will admit of, conſiſtent with ſafety to the movers and the marble; but the power gained by that method never can come near the power which can be produced by the ſteelyard purchaſe, for it is perfectly practicable in this purchaſe to make the power equal to what a ſingle capſtan, or windlaſs would be of 0. 1 of an inch in diameter. Now we know of no materials which a capſtan, or windlaſs could be formed of, whoſe diameter muſt be 0. 1 of an inch, and bear ſome tons of weight; nor do we know of any ſubſtance for a rope or chain that could bear (to uſe a ſea man's expreſſion) ſo ſhort a nip with any conſiderable weight attached to it without very ſoon being deſtroyed.

☞ The Meaſure of the Dimenſions in the Table is in Inches, and decimal Parts of an Inch.

TABLE.

Capſtans.		Power encreaſed Number of Times.	Gains on the Rope the Block is faſt to, in one Turn round of the Capſtan.
Great Barrel.	Small Barrel.		
Inches.	Inches.		Inches.
24.	12.	2.	18.852
	15.	2.66	14.139
	18.	4.	9.426
	21.	8.	4.713
	23.	24.	1.571
30.	15.	2.	23.565
	18.	2.5	18.852
	21.	3.33	14.139
	24.	5.	9.426
	27.	10.	4.713
	29.	30.	1.571
36.	18.	2.	28.278
	21.	2.4	23.565
	24.	3.	18.852
	27.	4.	14.139
	30.	6.	9.426
	33.	12.	4.713
	35.	36.	1.571
42.	21.	2.	32.991
	24.	2.33	28.278
	27.	2.8	23.565
	30.	3.5	18.852
	33.	4.66	14.139
	36.	7.	9.426
	39.	14.	4.713
	41.	42.	1.571

Capſtans.		Power encreaſed Number of Times.	Gains on the Rope the Block is faſt to, in one Turn round of the Capſtan.
Great Barrel.	Small Barrel.		
Inches.	Inches.		Inches.
48.	24.	2.	37.704
	27.	2.2857	32.991
	30.	2.66	28.278
	33.	3.2	23.565
	36.	4.	18.852
	39.	5.33	14.139
	42.	8.	9.426
	45.	16.	4.713
	47.	48.	1.571
54.	27.	2.	42.417
	30.	2.25	37.704
	33.	2.5	32.991
	36.	3.	28.278
	39.	3.6	23.565
	42.	4.5	18.852
	45.	6.	14.139
	48.	9.	9.426
	51.	18.	4.713
	53.	54.	1.571
60.	30.	2.	47.130
	33.	2.22	42.417
	36.	2.5	37.704
	39.	2.8571	32.991
	42.	3.33	28.278
	45.	4.	23.565
	48.	5.	18.852
	51.	6.66	14.139
	54.	10.	9.426
	57.	20.	4.713
	59.	60.	1.571

Capſtans.		Power encreaſed Number of Times.	Gains on the Rope the Block is faſt to, in one Turn round of the Capſtan.
Great Barrel.	Small Barrel.		
Inches.	Inches.		Inches.
66.	33.	2.	51.843
	36.	2.2	47.130
	39.	2.44	42.417
	42.	2.75	37.704
	45.	3.142	32.991
	48.	3.66	28.278
	51.	4.44	23.565
	54.	5.5	18.852
	57.	6.66	14.139
	60.	11.	9.426
	63.	22.	4.713
	65.	66.	1.571
72.	36.	2.	56.556
	39.	2.181	51.843
	42.	2.4	47.130
	45.	2.66	42.417
	48.	3.	37.704
	51.	3.428	32.991
	54.	4.	28.278
	57.	4.8	23.565
	60.	6.	18.852
	63.	8.	14.139
	66.	12.	9.426
	69.	24.	4.713
	71.	72.	1.571

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